NEW ORLEANS FORECAST DISTRICT.

No well-marked disturbance crossed the district during the month, and no special warnings were issued. Scattered thunderstorms, which were generally covered in the forecasts, occurred on several dates. There were frequent rains, especially during the last decade.—*I. M. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

No storm warnings were ordered and no general storms for which warnings should have been ordered occurred on the upper Lakes.

A forecast of light frost in the cranberry district was issued on the 21st, and, according to reports, the forecast was verified. It is believed, however, that no damage was done to the cranberry crop.—*H. J. Cox, Professor and District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

No unusual storms passed over the district during the month, though during the middle and latter half there were frequent thunderstorms and heavy rainfalls. After the 18th, there was not a day on which more or less heavy and general showers did not occur over the district. The first ten days, however, were mostly fair and warm. The thermal condition of the month was about normal, with no marked departures.—*Ferdinand J. Walz, District Forecaster.*

DENVER FORECAST DISTRICT.

No unusual weather conditions prevailed.

As a result of the melting of snow in the higher mountains of Colorado, streams on all slopes of the Continental Divide were badly swollen during the first half of the month. Considerable damage resulted in the vicinity of Florence, on the Arkansas, and also in the southwestern part of Colorado.

In the Rio Grande, at El Paso, the highest stage was reached the morning of the 1st, after which there was a gradual decline until the 8th, when, as a result of heavy rains, there was a material rise in the river for 200 miles north of El Paso. After the 17th, the river, in its lower reaches, fell steadily.

These different stages were accurately forecast, as was also a moderate rise in the Arkansas for a short distance below Pueblo.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The season continues abnormal. There appears to have been a permanent depression over the southwestern portion of the country. The Pacific "high" may be inferred to have either swung somewhat westward or lost energy. The season has been cool and it is reported by masters of transpacific steamers that not for ten or more years has it been so cool on the Pacific.

No rain has fallen in California. A few thunderstorms in the mountains were reported. The locus of unsettled weather was in northeastern Nevada, southern Idaho, and northern Utah.

No storm warnings were issued during the month.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was showery and cooler than usual. No special warnings were issued or needed, except for a slight rise in the Columbia River, due to melting snow in the mountains. Ordinarily the Columbia River is in flood during the months of May and June, but this year the rise was so small as to cause but little inconvenience. The highest stage at Portland occurred June 16, and it was only 13.6 feet, which is the lowest spring high water that has occurred during the last 26 years, with the exception of the year 1889, when the highest stage reached was ten feet.

The public was advised early in April that the winter snowfall in the mountains within the drainage area of the Columbia River was the smallest in many years, and consequently the low stages that followed were anticipated.

Mr. A. B. Wollaber made the forecasts from June 1 to June 17, inclusive, and the undersigned during the remainder of the month.—*Edw. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The reputation of June as a month of floods was well sustained during the present month. There was a short but very destructive flood in the upper Mississippi and its tributaries during the first half of the month, which, however, did not extend below the mouth of the Illinois River; another great flood in the Grand River of Michigan, almost as extensive as the overflow of the previous year; continued floods in the Rocky Mountain States, doing still more damage to railroads, bridges, and farms; a moderate but greatly prolonged flood in the Red and Ouachita rivers, some close approaches to the danger lines in the lower Arkansas, and some local floods in the interior of New York. The Mississippi River flood, and also that in the lower Des Moines River, began on the 10th from La Crosse to Hannibal, and were due to the heavy downpour of rain on the 9th and 10th. At Leclaire, Iowa, the rainfall for 24 hours was 4.41 inches; at Davenport, Iowa, 4.59 inches; at Burlington, Iowa, 6.04 inches; at Keokuk, Iowa, 4.68 inches, and at Warsaw, Ill., 4.00 inches. In the lower Des Moines Valley the rainfall was torrential, 10.09 inches having fallen in 12 hours at Keosauqua, Iowa.; 10.63 inches in 12 hours at Stockport, Iowa, and 12.10 inches in 12 hours at Bonaparte, Iowa. There could be but one result from such a torrent of water. The lower Des Moines Valley at once became an inland sea. The rain and rising waters came so suddenly that no special warnings were practicable. At Keosauqua, Iowa, the river rose 16.3 feet in seven hours to a stage of 20.2 feet, and finally reached 23.5 feet during the afternoon of the 10th. This stage was 0.2 foot higher than the high-water mark of 1851, 1 foot higher than that of 1897, and 4 feet below that of 1903, the highest stage of record.

The torrent from the Des Moines River speedily passed into the Mississippi and at Keokuk, Iowa, the combined effect of the upper Mississippi, the Cedar, Iowa, Skunk, and Des Moines rivers caused a rise of 8.4 feet to a stage of 18.4 feet during the 19 hours ending at 2 p. m. June 10. At Warsaw, Ill., at the mouth of the Des Moines River, the rise was 8.2 feet in 28 hours to a maximum of 21.3 feet, 3.3 feet above the danger line.

It is impossible to give an accurate estimate of the damage caused by these floods. Farms and railroads were the greatest sufferers, and the losses from various causes must have amounted to millions of dollars. Estimates varying from $5,000,000 to $15,000,000 have been received. Very fortunately the loss of life was small, only two fatalities having been reported.

The following report on the flood in the Keokuk, Iowa, district was made by Mr. F. Z. Gosewisch, Official in Charge of the U. S. Weather Bureau office, Keokuk, Iowa:

On Friday, June 9, the river was falling at the rate of 0.2 to 0.3 foot a day, with every indication that this rate of fall would continue for several days. At 5 p. m. the stage was 10.0 feet, with the river still falling.

During the afternoon light showers fell, but at 8.30 p. m. heavy thunderstorms began, and by 9.15 a. m. of the 10th, 4.62 inches of rain had fallen, with a total of 4.80 inches for the 24 hours.

The river began to rise rapidly at midnight, rose four feet by 7 a. m. of the 10th, and reached the highest stage, 18.4 feet, by 2 p. m., a rise of 8.4 feet in fourteen hours.

It was apparent from the rapidity with which the river rose that the flood was due entirely to excessive rains within the immediate vicinity of the Mississippi and Des Moines rivers.

From Nashville, Iowa, seven miles north of Keokuk, it was reported that a square box, freely exposed on the bow of a boat, received twelve inches of water, and at Hamilton, Ill., opposite Keokuk, a mortar box is said to have received ten inches of rainfall.

The rise was so sudden and unexpected that there was no opportunity for sending telegraphic warnings. In fact, on the morning of the 10th telegraphic service was so badly interrupted that the first reports were not received until 12.30 p. m.

The Weather Bureau office at Hannibal was given the morning report

by telegraph, and at 2 p. m. all available information was telegraphed, consisting of the stage of river at Keokuk and Warsaw, and the special reports from Des Moines, Iowa City, and Mount Pleasant.

Between 8 and 9 a. m. the Egyptian levee, on the south bank of the Des Moines River, broke in three places at points from five to eight miles above the mouth of the river, flooding a tract of land ten miles long by eight miles wide in Clark County, Mo. These lands were mostly planted in corn and wheat, and the crops are a total loss.

Before noon of the 10th all railway service along the west side of the Mississippi River had been stopped by the washing out of bridges, etc., and heavy landslides from the bluffs overhanging the railway between Keokuk and Burlington also interfered greatly with railway traffic.

On the Iowa side of the Des Moines River the lands are not protected and were flooded from one-half to one mile inland. These lands were mostly planted in corn, but in the immediate vicinity of Keokuk a tract of several hundred acres, belonging to the Keokuk Canning Company, and planted in tomatoes and cucumbers, was a total loss. A small amount of stock was lost, principally in Clark County, Mo., and one man was drowned, the wagon in which he was driving being swept away by the current.

The rainfall observer at Mount Pleasant, Iowa, in the Skunk River watershed, reported 5.72 inches of rainfall on the morning of the 10th, and an additional 1.56 inches on the morning of the 11th, while Iowa City reported 3.98 inches on the morning of the 10th.

The Skunk River levee broke on the morning of the 11th, at a place known as the Matterson farm, one-half mile east of the bluff, and the damage in that district is estimated at $32,000.

The greatest damage in this vicinity, however, was caused by a small stream known as Lost Creek, a tributary of the Skunk River, whose flood waters caused a loss of $43,000 in growing crops.

Judging from the amount of precipitation over the tributary watersheds of the Mississippi River, it was expected that the Mississippi would rise slowly for at least 48 hours, but the highest point was reached at 2 p. m., June 10, after which hour the river fell steadily, falling below the danger line on the afternoon of June 12. On the 13th, the water had receded from all the overflowed lands. The very rapid rate of rise and fall showed conclusively that the heavy precipitation had been limited to a comparatively small area.

The conditions in the Hannibal district, immediately below, were not so serious, yet considerable damage was done to unprotected crops in the lowlands.

The following report of the high water was made by Mr. B. L. Waldron, Official in Charge of the U. S. Weather Bureau office at Hannibal, Mo.:

The Mississippi River was unusually high during the entire month of June, 1905, and, while only a sprinkle of rain fell at Hannibal until the 19th, the excessive rain of the 9–10th over southern and eastern Iowa, the northeastern corner of Missouri, and adjacent portions of Illinois, caused a flood to rush down the Mississippi with remarkable rapidity.

The river at Hannibal began to rise during the late afternoon of the 10th, at a stage of 11.3 feet, and reached a stage of 18.3 feet at 5 p. m. of the 12th, a rise of 7.0 feet in about 48 hours.

Flood warnings were issued at 3 p. m. of the 10th, forecasting a stage of nearly twenty feet by the 13th, and another on the morning of the 12th, stating that a stage of about nineteen feet would be reached, and that the decline would commence on the 13th. These warnings were timely and of great value; nothing movable was destroyed or damaged at Hannibal, Quincy, or other places that could be reached with the warnings.

There was a little seepage through the Sny levee. The new South River levee, protecting Bay Island, stood the flood well, except at the outlet gates, where much trouble was experienced. Constant work for two days was necessary to save the levee and the property that it protects.

All crops on unprotected lowlands were destroyed, and there are probably 6000 to 10,000 acres of such land under cultivation between Quincy, Ill., and Louisiana, Mo. Most of the business houses on Main street, Hannibal, were compelled to remove their goods from the cellars, and the railroads were put to some inconvenience, but no material loss occurred in this vicinity.

The river fell rapidly from the 13th to the 19th, inclusive, reaching a stage of 11.5 feet on the latter date. It then again began to rise steadily and by the 27th a stage of 14.8 feet was recorded. Flood warnings were issued on the 21st, forecasting a stage of fourteen to fifteen feet, and this forecast was repeated daily until the crest was reached.

At the end of the month the river was still above the danger line, with a stage of 14.4 feet. There was no damage done during the last rise, although it effectually prevented the replanting of the overflowed lowlands.

The flood in the Grand River of Michigan was remarkable for the time of its occurrence as well as for its serious character. Floods, worthy of the name, had hitherto been unknown during the summer months over this watershed, and a June flood was certainly most unexpected. The situation was almost as serious as during the great flood of March, 1904. At that time there was no river and flood service in existence in Michigan, and no warnings of the flood could be given. During the present flood the service was in full operation and by its excellent work did much to minimize the danger and damage. Much damage was done, but none that could have been prevented. The warnings were uniformly excellent, and were the subject of highest commendation from all concerned.

The following report on this flood was prepared by Mr. C. F. Schneider, Official in Charge of the U. S. Weather Bureau office at Grand Rapids, Mich.:

The June flood in the Grand River of Michigan was unprecedented. High water in this river is no unusual occurrence, but it usually occurs in the spring when the melting of the winter snow and ice and the frosty condition of the soil are important factors in causing it. Moderate summer floods have occurred in the past, due in part to log jams, but high water such as occurred this year has never been known before. In past years log jams have formed above Grand Rapids early in the summer, damming and holding back the water. With the breaking of the jam the waters were suddenly released, flooding the lower portions of the river. Owing to the decline of the lumber industry in this section of the State, such floods have not occurred in recent years.

The month of May marked a period of excessive rainfall throughout the lower portion of the State, the rainfall in the Grand River basin exceeding the normal by 2.36 inches. The first few days of June were moderately dry, although the soil remained thoroughly soaked with water. On the night of June 4–5 heavy rains of about one inch occurred in the western part of the State. At this time an area of low pressure was central over the upper Missouri Valley. During the 24-hour period ending June 6 the storm advanced eastward to the upper Mississippi Valley and caused excessively heavy showers over a large portion of the Lake region, the falls in southern Michigan being the heaviest. During the 36 hours ending Tuesday morning, June 6, an average of 5.13 inches of rain fell over the Grand River basin. The rains were torrential downpours that immediately congested the creeks and rivers tributary to the Grand and caused the river to rise from a moderately low stage on Monday evening to a moderately high stage on Tuesday morning, a period of 12 hours, and to stages above the danger line at all points 24 hours later, or Wednesday morning, June 7.

The following table of precipitation is of value in connection with this flood:

Precipitation at stations along the Grand, Cedar, Looking Glass, and Thornapple rivers during the month of May, with departures from the normal, and from June 1 to 6, inclusive.

Station.	River.	May.		June.						
		Amount.	Departure.	1	2	3	4	5	6	Total.
Jackson	Grand	6.12	+2.49	.03	T.	.24	.78	2.15	0.79	3.99
Fitchburg	*Cedar	6.37	+2.01	T.	0	0	.28	0.40	3.15	3.83
Webberville	*Cedar	4.36		0	0	0	.10	1.13	4.76	5.99
Agricultural College	*Cedar	5.17	+1.95	0	0	0	.11	0.45	5.47	6.03
Lansing	Grand	5.51	+1.98	0	.01	0	.18	0.28	4.92	5.39
St. Johns	*Looking Glass	5.46	+2.37	0	0	0	.04	2.18	3.90	6.12
Charlotte	*Thornapple	3.79								3.50
Hastings	*Thornapple	6.60	+3.22	0	0	0	.68	0.50	3.60	4.78
Ionia	Grand									6.31
Grand Rapids	Grand	5.97	+2.49	0	.20	0	.36	1.20	3.56	5.32
Averages		5.48	+2.36	T.	.03	.03	.32	1.04	3.77	5.13

* Tributaries to the Grand.

The sudden rise which occurred during the night of June 5–6 and the reports of the heavy rainfall throughout the State prompted this office to at once put the river service into operation. Telegrams were immediately dispatched to all of the river observers, directing them to take and forward observations at once, and to continue sending reports at 7 a. m., noon, and 7 p. m. until further notice. From observations received at noon, June 6, it became evident that warnings were necessary and they were at once sent out to all places along the river, advising all interests that the river would rise above the danger line by Wednesday morning, and that a probable further rise would occur by Thursday morning. Further warnings were sent out on Wednesday and Thursday, June 7 and 8, and by Friday morning the river had reached the high-water mark of the flood, 18.1 feet, or 7.1 feet above the danger line, and only 2.3 feet below the highest water ever known at Grand

Rapids. Flood conditions prevailed until Thursday, June 15, by which time the river had fallen below the danger line.

The great value of the River and Flood Service was amply demonstrated during this flood and I believe it may be stated with perfect accuracy that hardly a dollar's worth of property was lost that could have been saved. On account of the accurate and timely warnings very many thousand dollar's worth of property was removed from basements, stores, and factories out of the reach of the high water, but a large amount of machinery and other property that could not be moved was considerably damaged, while the business of many factories was entirely suspended.

The floods in Colorado and New Mexico partook of the usual character of mountain floods and are thus described by Mr. F. H. Brandenburg, Official in Charge of the U. S. Weather Bureau office at Denver, Colo.:

During the first half of June high stages were general in all streams rising on the slopes of the Continental Divide in the central mountain region, where, owing to the cold spring, the melting of snow had not progressed gradually as usual.

The Arkansas remained high for an unusually long period. From the 2d to the 12th low bottom lands were overflowed, and considerable damage was done to farming lands in the vicinity of Canyon City and Florence. Railroads were put to considerable expense to protect their roadbeds between Pueblo and Salida.

The danger line on the Gunnison was reached at Grand Junction on the 12th, and the highest stage at midnight of June 5; this stage was four inches above the highest recorded in the last ten years. The stream fell below the danger line on the 6th, but rose nearly as high on the 9th, as a result of rains. Many bridges were washed away, and low-lying agricultural and fruit lands were considerably damaged.

A number of dams and reservoirs near the headwaters of the Grand were overtaxed and destroyed. The river was out of its banks between Rifle and New Castle.

In southwestern Colorado the Animas reached a stage equaling that reached in 1884, the highest known. Lowlands were overflowed, and two foot and five county bridges in Durango were washed away. The railroad between Durango and Telluride suffered interruption to traffic by the loss of bridges and the washing out of a large section of track along the Dolores River. The San Juan River, in southeastern Utah, was very high about the middle of the month.

In Arizona the lower Colorado was bank full at Yuma from the 12th to the 20th, and at flood stages from the 21st to the 28th, overflowing, and doing much damage to farms and crops. The river subsided rapidly after the 28th.

The streams of Wyoming carried large volumes, in some cases the largest in years, but no serious damage was done.

The disastrous flood in the Rio Grande which set in during the closing days of April, was at its maximum at different points in New Mexico on May 25 or 26, and reached the highest stage, 14.3 feet, at El Paso, Tex., on June 1.

Showers interrupted the steady and general decline that began with June, and from the 3d to the 12th destructive stages prevailed in northern New Mexico. While the resulting increase in volume in southern New Mexico was not great, it prolonged the flood stage by a week or ten days. At San Marcial the maximum stage during June, 12.7 feet, occurred on the 1st, and again on the 9th and 11th, after which there was a rapid decline; the danger line of 11 feet was passed on the 15th, 9.0 feet, on the 22d, and 8.0 feet at the close of the month. At El Paso on the 9th and 12th, the gage reading was 13.7 feet; on the 21st, 12.3 feet, a fall of one foot in four days, and at the close of the month an additional fall of 2.5 feet was noted.

Between Rincon and El Paso the railroad tracks were repeatedly washed away and large tracts of farming lands, both above and below El Paso, were cut off and carried away by the rapid current and the changing channel.

The following report of the flood in the Red River was made by Mr. J. W. Cronk, Official in Charge of the U. S. Weather Bureau office at Shreveport, La.:

Excessive rainfalls were frequent over the upper Red River watershed during April and May, and at Shreveport the rainfall for these two months was 19.62 inches. Flood stages naturally resulted and from the middle of May until the middle of June the Red River was continuously above the danger line over the greater portion of its course in Arkansas and Louisiana. Two crests were noted at Fulton, Ark., 28.9 feet on May 18, and 31.5 feet on June 1, 2, and 3. At Shreveport the river rose to the danger stage of 29 feet on May 26, and continued to rise slowly until the crest stage of 33.6 feet was reached on June 9. There was then a gradual fall to below the danger line on June 18.

Warnings were thoroughly disseminated well in advance of the flood to all interests in Red River Valley. The first warnings for the valley from Fulton to Shreveport were distributed by mail on May 13. On May 22, owing to further heavy rainfalls, a flood warning was distributed by telegraph in Arkansas and by mail in Louisiana, advising immediate removal of all families, stock, and perishable property to places of absolute safely. Further warnings and forecasts were issued as varying conditions for different localities required. The time and height of the crest stages were accurately forecast and were amply sufficient for the needs of all interested.

The losses from the effects of the floods in Arkansas and Louisiana were probably more than $100,000, the greater portion being attributable to the curtailment of cotton acreage on lands unprotected by State levees. The Texas and Pacific Railway from Shreveport, La., to Texarkana, Ark., also suffered severely, all train service being entirely abandoned for about one month. However, the total loss was comparatively small, as the value of property protected by State levees, and the value of stock and other movable property saved through the instrumentality of the Weather Bureau warnings has been conservatively estimated at more than $5,000,000. Individuals here and there were nearly ruined by the breaking up of farms, caving in of banks, and breaks in private levees, but no loss of life was reported.

The floods in the Ouachita and Arkansas rivers were not unusual in any respect and were forecast at the proper times. There was some trouble with weak levees in the Shreveport district of the Red River, but they were strengthened in time to prevent crevasses.

The highest and lowest water, mean stage, and monthly range at 283 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Divison.

The following summaries relating to the general weather and crop conditions during June are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon reports from cooperative observers and crop correspondents, of whom there are 3300 and 14,000, respectively:

Alabama.—Weather generally fairly favorable for growth and work; cultivation progressed steadily, except retarded by rain in northern, western, and some southern counties; rainfall deficient in central and eastern counties. Cotton improved slowly; mostly clean at close of month; plants small, but healthy, and fruiting satisfactorily. Corn and minor crops advanced well, except some deterioration where rainfall was deficient; some corn ruined by overflow in northern counties. Wheat and oat harvest completed; oats good yield, wheat light.—*F. P. Chaffee.*

Arizona.—Copious rainfall first decade; droughty conditions 12th to 30th. Temperature below normal. Grain harvest continued throughout month; yield fair; quality good; some damage from rust. Crop growth made good progress north. Fruit yielding largely in central and southern sections; drying extensive. Killing frost north section on the 16th injured fruit and vegetables slightly. Floods in the lower Colorado on the 21st to 28th washed farm lands and damaged crops. Third alfalfa cutting began on 28th. Water supply diminishing. Cattle and sheep in good condition.—*L. N. Jesunofsky.*

Arkansas.—The temperature was seasonable, with local showers in the first and second decades and general rains in the third. Cotton planting was practically completed; the crop made a good, healthy growth and was generally clean by the close of the month. Early corn suffered for moisture in the second decade, but improved during the third; the late planted came up to a fair stand. Oats were good and wheat poor. Apples dropped badly and a light crop was indicated; other fruits did well.—*Edward B. Richards.*

California.—Clear and cool weather prevailed throughout the State most of the month, and both temperature and rainfall were below normal. Thunderstorms in the northern sections and high winds in the San Francisco Bay district caused no material damage. Field fires in the San Joaquin Valley destroyed several thousand bushels of grain. Grasshop-